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(PH-38)

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SUMMARY

Optical flare in a flying-spot telecine arises mainly in the flying-spot tube. The flare is of two types, one caused by multiple reflections in the tube faceplate, and the other by reflections within the bulb of the tube. The first ('a.c.') type of flare may be reduced considerably either by incorporating a neutral-density faceplate during manufacture, or by cementing one on to an existing tube. The other ('d.c.') type of flare caused by reflections inside the tube, may be reduced by modifications to the interior coating of the bulb of the tube to make it reflect as little light as possible. Both types of flare may be reduced by 50%.

1. INTRODUCTION

Recent improvements in telecine design and operating procedures (e.g. the introduction of electronic masking and low-gamma operation) cause distortion due to telecine flare to be more noticeable. The flying-spot tube itself was found to be a major contributor to the flare; the types of flare observed, conveniently called 'a.c.' and 'd.c.' flare respectively, are described below, and remedial measures are considered.

2. 'a.c.' FLARE

A 'spreading' of the image in the telecine output picture from a light area to a dark area at a boundary between them, is the main characteristic of a.c. flare. This type of flare is related to low-frequency components of the a.c. signal component. The flare is caused by internal reflections in the faceplate of the flying-spot tube. Reference 1 indicates that a faceplate having a neutral density of about 0·2 reduces this type of flare by about 60% with a signal/noise ratio penalty of about 1 dB.

3. 'd.c.' FLARE

A 'sit' added to the whole picture, and varying with the integrated brightness of the picture, is the main characteristic of d.c. flare. This quasi d.c. component is caused by stray light from the flying-spot raster, which finds its way through the film being scanned. The greater part of this stray light comes from the back of the phosphor, is reflected around the interior of the tube and is then diffused by the phosphor (by this time the light is so scattered as to be uniform over the phosphor area), so causing unwanted illumination of the film. A certain amount of excitation of the phosphor from stray electrons also takes place. In most flying-spot tubes, the interior of the tube is highly reflective, as it becomes coated with aluminium when the back of the phosphor is aluminised. It was suggested that an experimental tube be made in which the aluminising is confined to the back of the phosphor and the remainder of the tube interior is coated with a matt-black substance to reduce its reflectivity to a minimum. This was carried out and the tube was tested in Research Department.

4. PRELIMINARY TESTS ON EXPERIMENTAL TUBE HAVING BLACK-COATED INTERIOR

The experimental tube had a neutral faceplate of density about 0·2 cemented to it and was installed in a flying-spot scanner. The subjective impression of a preliminary performance test was that flare was reduced and the picture contrast range was abnormally good. Measurements using a test slide consisting of an opaque black patch in the centre of the field indicated that the total flare was about half that associated with a standard tube having a conventional faceplate and an aluminised interior. More accurate measurements comparing the experimental tube with a standard one were then made on a test bench.

5. TEST BENCH MEASUREMENTS

Each tube, in turn, was mounted in a test bench fitted with normal scanning and focus coils and equipped to provide all the normal operating potentials and scanning and focus currents. In addition, arrangements were made to apply a blanking waveform to the tube so as to produce a large rectangular black patch near the centre of the scanned raster.

A photomultiplier was arranged to scan across the face of the tube by means of a travelling microscope assembly. The photomultiplier had a very narrow angle of acceptance; thus the brightness of any point on the tube could be plotted against its position as measured by the travelling microscope. The black patch was made large so that its centre was as free as possible from the effects of a.c. flare. Thus

only a rectangular frame around the outer part of the raster was illuminated and the actual flare figures obtained at the centre of the black patch were less than the flare produced by a complete raster. The ratio between the flare intensities of the standard tube and the experimental tube was, nevertheless, correct.

6. DISCUSSION

The results of the test-bench measurements are shown in graphical form, plotted on a log/linear scale in order to indicate the light levels corresponding to the black patch more clearly. A black patch large enough to have its centre unaffected by a.c. flare could be expected to give rise to nearly uniform brightness in the area where only the uniform d.c. flare was present (see Fig. 1). However, the black patch could not be made large enough for a flat part of the curve to appear without making the total light output too small for satisfactory measurement of the very low light levels in the centre of the black patch. Nevertheless, the effect of a.c. flare at the centre is small enough for the curves to give a good idea of the relative performance of the two tubes. Fig. 1 indicates that the d.c. flare from the experimental tube is about one-third of the flare of a standard tube. However, in the telecine machine the effects of flare in the lens, etc. reduces this advantage and the pictures obtained with the experimental tube have about half the flare of those obtained with the standard tube.

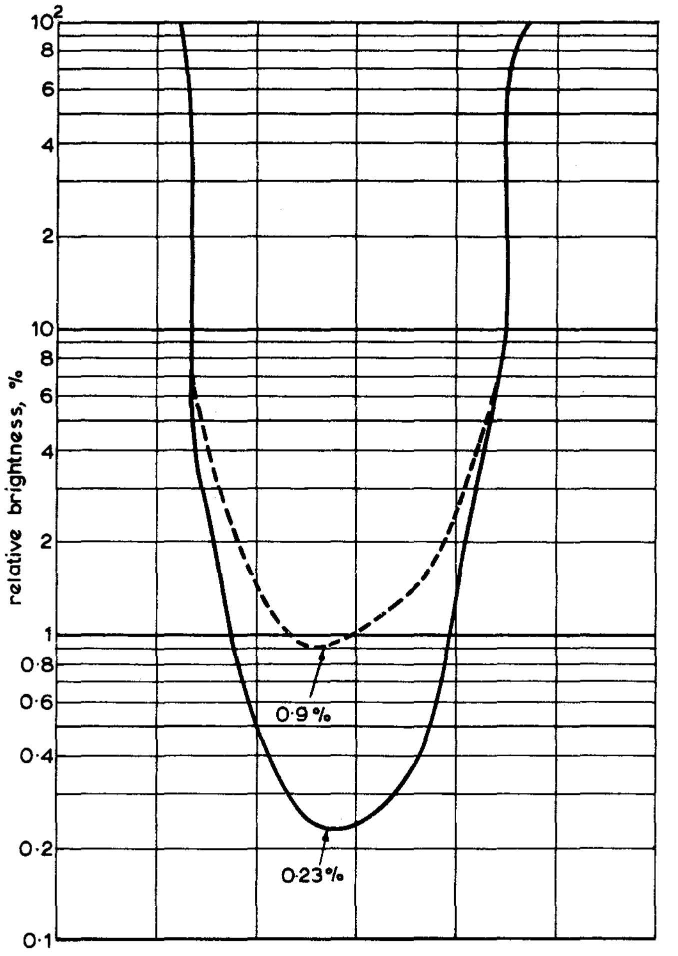

Fig. 1 - Flare profile across black-patch

——— Experimental tube

------ Normal tube

7. CONCLUSION

There is a worthwhile improvement in d.c. flare performance of a telecine machine when the flying-spot tube has a blackened interior. A precise figure is difficult to give since there are flare contributions from the optical system.

It is recommended that all flying-spot tubes have a non-reflecting interior, and a neutral faceplate of density about 0·2. The loss of about 1 dB in signal-to-noise ratio is a worthwhile price to pay for the reduction in picture impairments due to flare.

8. REFERENCE

1. A comparison of two flare-reducing methods in conventional cathode-ray tubes. BBC Research Department Report No. T-075, Serial No. 1960/19.

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